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Effect of Carrier to Noise Ration threshold filtering on the long-term wind speed and Weibull distribution parameters for a pulsed heterodyne wind lidar

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Wind speed observations from tall towers are used in combination with observations up to 600 m in altitude from a pulsed heterodyne Doppler wind-lidar (Leosphere WLS70) to study the long-term wind profile over sub-urban, coastal-rural and marine areas.

When the Doppler wind-lidar Carrier to Noise Ratio (CNR) is lower than a threshold value (typically - 22 dB) the observations are often not used as the uncertainty in the wind speed measurements has increased above a certain value. Here we discuss some consequences of the filtering on the on measured long-term wind speed and Weibull distribution parameters. The analysis shows that the mean wind speed is a function of the applied CNR threshold, since the CNR is a direct consequence of the atmospheric aerosol and dust concentration driven by changes in near-surface wind speed.

For concurrent and complete profiles, i. e. profiles which have a CNR larger than a given threshold at all measuring levels up to 600m, use of the traditional -22 dB CNR threshold value results in a ~7% over-prediction of the long term mean wind speed over land, and a ~12% over-prediction in coastal and marine environments. In addition, the height of the maximum in the profile of the shape parameter of the Weibull distribution (so-called reversal height) was found to depend on the applied CNR threshold; it is found to be lower at small CNR threshold values.

When the wind-lidar measurements were filtered with the same CNR threshold at 100 m only, the effect on the wind speed was less, being a 1% over-prediction over land and 7% over-prediction in coastal and marine areas.